SCIENCE

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THE AIMS AND OBJECTS OF THE SOCIETY OF THE SIGMA XI[1]

IT is provided in the constitution of the Society of the Sigma Xi that the president shall explain the aims and objects of the society to the members-elect. In the form of initiation prescribed in the constitution for all the chapters of this honorary scientific society this part of the program precedes the reading of the formal pledge, which is as follows:

> Do you hereby pledge yourself to uphold the principles of the Society of the Sigma Xi, and assume the responsibilities incumbent upon active membership therein?

The Constitution states that:

> The object of this society shall be to encourage original investigation in science, pure and applied, by meeting for the discussion of scientific subjects; by the publication of such scientific matter as may be deemed desirable; by establishing fraternal relations among investigators in the scientific centers; and by granting the privilege of membership to such students as have, during their college course, given special promise of future achievement.

Its motto is

> Companions in zealous research.

This pledge has been read, to which later you will be asked if you assent, and also the section from the constitution defining the object of this society, which later you will be asked to sign, in order that you may have both of them in mind during the following remarks.

The constitution does not prescribe the form in which the "aims and objects of the Society" shall be explained to the members-elect, but leaves to the president great latitude as regards these matters. What I

[1] President's address to the Omega Chapter (Ohio State University), May 21, 1914.

have to say this evening is not, therefore, to be accepted without question as the authoritative policy of this society; but rather as my personal opinion based upon observation during its entire history and a fairly intimate acquaintance with its foundation.

Most of you are probably aware that it was organized at Cornell University and that chapter is known as the Alpha. At least as early as 1883 Professor Henry S. Williams, of Cornell, was thinking about the organization of a society which should recognize in some way the attainment of students in science as Phi Beta Kappa did in literary lines. During commencement week of June, 1886, there was organized the Society of Cornell University Geologists by Professor Williams; but its scope was not broad enough to satisfy him and later he drew up a preamble for a national scientific organization which was named the Society of Modern Scientists. One paragraph of the preamble stated that

> Therefore we believe it is highly desirable to encourage high attainments among the future students of Cornell University and other kindred institutions by recognizing by some mark of honor those who exhibit special ability in investigating, understanding and interpreting the facts of nature in the various branches of modern science.

Independently, shortly before the Cornell Commencement of 1886 two engineers, William A. Day and Frank Van Vleck, planned the formation of an honorary scientific society. The following fall they associated with themselves seven other engineers and began work on the formal organization of such a society, for which they selected the name Sigma Xi. The preamble of the first printed constitution stated that they were "forming a brotherhood in Science and Engineering." The membership and its activities, however, supported the conclusion reached by many in contact with it that this was strictly an engineering society. Some time that fall Professor Williams learned of this movement when he attempted to interest the engineers in the formation of a general society to select men in the same way for membership from those departments of applied science that he was advocating for the departments of pure science. Suffice it to say, without relating all the details, that the two movements joined forces, and the formal organization of Sigma Xi was accepted as the working nucleus of a university honorary scientific society. The minutes of the second meeting of Sigma Xi state that the proposals of Professor Williams were accepted, and at the fourth meeting he was nominated for a member of the society and unanimously elected. This was in the fall of 1886 and made the charter membership of the society ten. At the next meeting four additional members of the faculty and five graduate students were elected to membership, so that twenty-seven years have passed since the first members, similar to those we have now met to initiate, were received into this society. During these years it has attained an honored position in the university world, as well as entrance to most of the institutions of learning in this country in which science is strong, so that there are now twenty-eight chapters with a total membership of 7,498, as recorded in the "Quarter Century Record History of Sigma Xi." So much for the history of this society to which you have been elected members.

Its aims may be explained in part by some account of the spirit of the institution in which it was born. In any list of the ultimate causes which led to the organization of Sigma Xi should be ranked very high the influence of Andrew Dixon White, the first president of Cornell University. A scholar, an author of renown, a diplomat, statesman, university professor and president, he certainly ranks among the few

really great university presidents this country has had. He was a member of the famous class of '53 of Yale, where he was elected a member of the honorary societies of Phi Beta Kappa and Skull and Bones, next a student at French and German universities and attaché at the St. Petersburg legation, then returned to this country and served for six years as professor of history and English literature in the University of Michigan. For four years he was a member of the New York State Senate, where in association with another senator—Ezra Cornell—he drafted the law which was passed creating Cornell University. Nominated by Mr. Cornell for president of the new institution and unanimously elected against his wishes by the other members of the board of trustees, Mr. White came to the presidency of Cornell University in 1867 at the age of thirty-five, familiar with the best in education both in this country and in Europe. This position he held with honor until 1885, and it is to be noted that the following year the two movements looking toward an honorary scientific society took definite form.

Three things stand out conspicuously in President White's administration which in my judgment are largely responsible for the spirit at Cornell which led to the organization of Sigma Xi.

In the first place, although himself a graduate of a leading classical college, he organized a university in the East where the scientific departments, both pure and applied, had the same dignity and in all respects equal rank with the departments of the humanities.

Secondly, he called to this faculty in nearly every case men of ability who either then were or became distinguished in their several fields of learning. As the speaker looks back upon his student days at Cornell he realizes that, with one or two exceptions, all his teachers were men who have attained positions of honorable distinction. They were men that measured up to the standard set by President Jordan when he wrote that

> it is true that no second-hand man ever was a great teacher. I very much doubt if any really great investigator was ever a poor teacher. How could he be? The very presence of Asa Gray was an inspiration to students in botany for years after he had left the class room. Such a man leaves the stamp of his greatness on every student who comes within the range of his influence.[2]

Sylvester, the great mathematician of Johns Hopkins University, in his Commemoration Day address is reported to have made the following statements:

> I hesitate not to say that, in my opinion, the two functions of teaching and working in science should never be divorced.
>
> I believe that none are so well fitted to impart knowledge as those who are engaged in reviewing its methods and extending its boundaries.[3]

Thirdly, President White took a personal interest in the development of the various departments and particularly in the research work of the faculty. I shall always remember his coming into the geological laboratory one afternoon with President Gilman, of Johns Hopkins University, to look at a collection of Trenton Trilobites which the university had recently purchased. Those two distinguished university presidents spent at least half an hour with Professor Henry S. Williams in looking at and discussing those fossils from the old Paleozoic rocks of New York. A scholar and distinguished investigator himself in his chosen field, he kept up his research work during all those early strenuous years of the university's life, and no one who was engaged in research work along any line received more cordial en-

[2] *Popular Science Monthly*, Vol. LXIV., 1904, p. 313.

[3] SCIENCE, N. S., Vol. I., February 22, 1895, p. 206.

couragement and recognition from any one than from President White. He had selected the faculty with care, and although he might not fully understand an investigation, he had confidence that the professor would attain creditable results and he gave him and his work most cordial support. Neither did he wait before giving such encouragement until the work had been published and favorably received; but not infrequently a professor received a spoken or written word of encouragement when without such encouragement perhaps it would have been abandoned. It is true that in those days the number of instructors in Cornell University was small, and likewise the number of students; but, after all, there was more of a true university atmosphere in the institution than is to be found in some of the present day which have almost as many thousand students as Cornell had hundreds in those old days.

In such an environment it was only natural after the organization of a chapter of Phi Beta Kappa in 1881, to which at that time in Cornell only those students who had training in at least one of the classical languages were eligible, that the scientific side of the university, which in every other way was on an equal footing with the literary side, should consider the formation of an honorary scientific society.

One of the objects of the Sigma Xi Society, as they were enumerated in its first published constitution, was:

> To supplement the regular course of instruction in science by original investigation.[4]

The speaker regrets that this sentence has been dropped from the constitution, which he believes reflected the spirit of Cornell University during the period of the conception and birth of this Society. Neither is it believed that this spirit has passed away, for in an address last fall by one of her distinguished linguistic scholars, Professor Schmidt, he said:

> Numbers alone do not make a great university. . . . Three indispensable factors in making a great university are: (1) competent investigators capable of increasing the world's knowledge; (2) distinguished teachers able to impart the most advanced knowledge, and (3) students eager for knowledge and passionately pursuing it.[5]

Professor Ward, of the University of Illinois, and corresponding secretary of the Society of the Sigma Xi, has also spoken, in a recent address, very emphatically concerning the importance of investigation for teachers. He said:

> Whatever private institutions may do, the state has no choice. The men who are its teachers must also be investigators and must contribute their share to the extension of knowledge.[6]

No less certain, however, were the words of Dr. Mendenhall on this campus last summer—the most distinguished living member of this university's early faculty—when he said:

> The university must also recognize, and in a generous way, its obligation to do its share in enlarging the boundaries of human knowledge. . . .
>
> During the last hundred years the relation of man to his environment has changed more than in all the past centuries of his history considered as one and this almost incredible material revolution is entirely the outcome of *applied* science. If there is to be no halt in this grand march there must be continued scientific *discovery*, the absolutely indispensable forerunner of the *application* of science. In original research, therefore, the "discovery of truth," the university of the state must, in the future, assume leadership, and let us hope that our own institution may always be found in the front rank.[7]

The principal object of this society is not, as many suppose, to confer an honor upon students of marked ability. It is an

[4] *Sigma Xi* [1887], p. 4.

[5] *Cornell Alumni News*, Vol. XVI., November 27, 1913, p. 106.

[6] Science, N. S., Vol. XXXVIII., December 12, 1913, p. 838.

[7] *Ohio State University Monthly*, November, 1913, p. 18.

honor, however, to be elected to membership in it, and one which the speaker would not attempt to minimize. In fact, he believes it would be worthy of support in this commercial age if it did nothing further than recognize those students who by the excellence of their standing in science have demonstrated that throughout their college or university course they have devoted their time to the things for which our higher institutions of learning were founded instead of to the many and various outside interests that now hinder and at times appear seriously to handicap the efforts of our large universities to give thorough scholastic training. He believes it fully worth the while of Phi Beta Kappa to recognize publicly those students that stand first in scholarly rank in their class, even if it did nothing else. It is said that this is undemocratic; but this democracy, as has often been pointed out by our European critics, is one of the dangers of American universities. One of these friendly students of American tendencies is Professor Marcks, the historian and Leipzig University professor, who after a recent sojourn in this country is reported as follows concerning

> the democratic idealism present in the American university as well as in the general life of the country. Its achievements are unmistakable. But, he asks, is there not this danger: that its aim can not very well rise above a highly respectable mediocrity? Does this practical system provide for the development of the rare personality, of the unusually gifted, of the intellectual aristocrat?[8]

There is no greater fallacy than the idea that all men are born equal, so far as mental ability is concerned. This fact appears to have been frequently lost sight of during recent years in the efforts to secure large numbers of students by those responsible for the administration of our universities. Professor Ward, of our own society, in a recent address has made a vigorous protest against this tendency to deterioration in our American universities. Among other things he says that:

> In the mad rush after students, all of our institutions alike have added to their own weakness rather than to their own vigor, and have wasted the resources of the people insofar as they have taken part in the struggle after mere bigness.[9]

Or as Dr. Mendenhall said at the fortieth anniversary of our own university:

> The efficiency of many colleges and universities is greatly impaired by the presence of large numbers of students quite unequal to the tasks they are supposed to perform.[10]

The real problem, as the speaker sees it, is whether the leaven of Sigma Xi and Phi Beta Kappa is sufficient to leaven the ever-increasing numbers of students that are entering our universities, a considerable proportion of whom are indifferent and poorly prepared.

The speaker would say that the encouragement of scientific scholarship is one of the objects of this society. The presidential address at the inauguration of the Alpha Chapter, on June 15, 1887, was entitled "The Ideal Modern Scholarship." Near the conclusion of this address Professor Williams stated that

> I find, then, three essentials to the ideal modern scholar of America:
>
> In learning he must master the elements of the current knowledge of the day; this is contemplated in the full scientific education of our universities.
>
> In means of communication, he must have acquired a thorough familiarity with his own language as a vehicle of thought. . . . Besides English, he must be able to use German and French; with these he can reach the civilized world.
>
> Thirdly, he must be a specialist, which means that he must take his place among the workers of

[8] *Cornell Alumni News*, Vol. XVI., October 30, 1913, p. 59.

[9] SCIENCE, N. S., Vol. XXXVIII., December 12, 1913, p. 834.

[10] *Ohio State University Monthly*, Vol. 5, November, 1913, p. 18.

the world, and fill that place. In his specialty he must think for himself, plan for himself, act for himself. Here he must rest on no one, but be himself a support for others.[11]

The question may be asked, what is scholarship? According to Professor F. C. Brown, of the State University of Iowa, the answer is: The discovering, the organizing and the explaining of new facts. Only the uninformed and unscholarly are in the habit of designating the mere diffusion of knowledge as scholarship.[12]

Further on in this address on "The Predicament of Scholarship in America" Dr. Brown discusses its "situation in our universities" and states that

they believe in general that productive scholarship is the most important function of a university and it is agreed that genuine scholars are of the most rare and difficult type to develop. But the difficulty with our universities is one that arises from mixed ideals, particularly in our state universities. The ideal of competition perhaps takes precedence of all other ideals in practise, and along with this is associated the ideal of efficiency in detail management of students. Surely a university wants scholars, but it wants a large number of students first. It wants more students in order to convince the people of its greatness, so that it may get more money so that it may establish more departments and so get more students, and so on. It must do extension work so that the work of scholars may reach every citizen of the land within a few days after it has been accomplished. Energy and resources that might be directed toward scholarship are scattered in every direction that human imagination can conceive of. The ideal in practise is not how great scholarship, but how thin it can be spread. In other words, there is in our scholarship a strong tendency toward democracy gone mad.[13]

Or, as Professor George J. Pierce, of Stanford University, says:

The wholesale business of the state universities limits if it does not prohibit that attention to the exceptional student which may result in training a leader of his generation, a seer who, divining the future needs of the state, may begin to prepare to meet them, a man who, profiting by the recorded experience of the past, may mold as well as meet conditions.[14]

The principal reason for your election to this society, as the speaker sees it, however, is that you have either made some contribution to science or that you give promise of being able to perform such service. This idea was so clearly expressed by Professor Titchener in his initiation address at Cornell some fourteen years ago that I can not refrain from quoting his remarks addressed personally to the members-elect of that chapter. He said:

Some of you are taken from the instructing staff of the university. You, Instructors, we welcome as proved men, tried servants of science, our common mistress. Many of you are drawn from the ranks of the graduate students. You, Graduates, we welcome, because you have paused now, at the outset of your career, to do something for the furtherance of human knowledge; and—what I think is more important even than that—because you have paused to prepare yourselves to carry the message of science into all those various spheres of activity to which you shall presently be called. Many of you, again, are undergraduates. You, Undergraduates, we welcome—not because you have done good work in your courses; anybody can do good work in his courses—but because we think we discern in you some promise of ability to perform scientific work, and some promise of good will to realize that ability. Weigh that well, you who are to form the youngest generation of this society of the Sigma Xi; do not think lightly of it, or of the men whose opinion it now is. . . . Remember now that there is not one of us, by whose voice you are sitting here before me to-night, who has not worked hard and worked successfully to swell the total of human knowledge and of human achievement.[15]

Therefore, young ladies and young gentlemen, you see that this chapter of Sigma Xi in electing you to its membership believes you have the ability and purpose to serve your generation in the dis-

[11] Professor Henry S. Williams, "The Ideal Modern Scholarship," 1887, pp. 7, 8.

[12] Science, N. S., Vol. XXXIX., April 24, 1914, p. 587.

[13] *Ibid.*, p. 589.

[14] *Ibid.*, p. 590.

[15] President's address to the Cornell Chapter of the Society of the Sigma Xi, June 9, 1900, pp. 14, 15.

covery and advancement of scientific knowledge, and by accepting such membership you promise, so far as lies within your power, to carry out this purpose. You will note, therefore, that membership in this society, providing one lives up to the trust imposed on him, carries with it certain responsibilities which, like the marriage vows, are not to be lightly assumed. It means, perhaps, in the first place that you are not to make the getting of money the foremost object of your life work. Now this fact alone to an American in this commercial age is a matter of grave importance and one that eliminates from our membership most of those who are actively engaged in "business, with its self-seeking and bargaining" in contrast to those in "the world of science, with its self-renunciation and mutual confidence." This is what Professor Titchener calls the "vow of honorable poverty" and the first one that a scientific man must take. The second vow is that of hard work, which is likewise not an easy one, since the natural inclination of most men is not toward strenuous exertion when it is not called for by the necessities of life. There is no use in trying to ignore the fact that in almost all cases the discovery of new facts requires hard and exhausting work for which in general there is no pecuniary reward that ranks at all with what would be secured if the same amount of energy were put forth in the commercial or professional world. And this fact again eliminates from the ranks of the real scientific workers the large majority of even college and university trained young men and women. Finally, Professor Titchener sets a third vow for the man of science, and that is isolation, which is perhaps after all, the most difficult one. As he said,

> The life of the man of science must be a lonely life. It is not only that we have, most of us, to do our scientific work, as Helmholtz said, in our spare time, so that we have little leisure for the amenities of the social life around us. That is something, truly; but there is more than that. If we are to carry science beyond her present bounds, in any field of work, we must specialize. And that means that we shall hardly find, away from university centers, even one or two of our acquaintances who are in intelligent sympathy with us; we must work alone. Even within a university, the number of men who thoroughly understand and appreciate their neighbor's work must be very small.[16]

In these days of university distractions it is difficult for even the men of most ability in the university circle to keep their leisure time for research instead of giving it to the multitudinous activities that beckon them away from such stern and severe work.

You are thinking, undoubtedly, that few and perhaps none of the members of Sigma Xi come up to this standard. It is granted at once, for this difference between the claims and the realities of the society has long been recognized. It is, however, the *ideal* toward which the society aims, and few human organizations come up to the full measure of the vision of their leaders. It is very true that you can find plenty of members of this society who have not apparently justified their election; but it is really after all a tribute to its standing that they wish to become and remain members. Probably for one reason or another, some good and others not, not even all of you who are present to-night for the purpose of initiation will in any considerable degree attain to the ideals that have been formulated for this organization. This mixed active and inactive membership of the society for a long time disturbed the speaker, as it has various others who are keenly interested in the high aims of Sigma Xi. In later years, however, he has come to consider that it is probably inevitable to a

[16] *Ibid.*, pp. 10–13, for the remarks concerning the vows of a scientific man.

considerable degree. If the active members of the chapters have a fairly clear appreciation of the meaning of the society and are conscientious in nomination and election of members, that is probably about all that can be expected. As the world in which we live to-day exists, the clever manipulator, the politician, or the man of unlimited assurance frequently fills the position of importance rather than the man of merit. Some will know the difference, but probably with the mass of people the man who has a big amount of assurance will very frequently be able to pass the counterfeit as the genuine. It is believed, however, that we ought not to be unduly discouraged by this fact, or that we should in any measure lower the standards and ideals of Sigma Xi. Even in the Church of God the saint and sinner, the genuine and the hypocrite, are associated. You will remember in the parable of the wheat and the tares that the householder commanded the servants not to attempt to separate the tares from the wheat "lest while ye gather up the tares, ye root up also the wheat with them." So in our own society it is believed that you are called to a great work, to help increase the sum of human knowledge, and one that calls for the best efforts that you can put forth. It is believed that this is a personal call to each one of you, so far as it may be possible to consecrate whatever God-given talent you possess to some earnest work toward the increase and dissemination of knowledge. It is also believed that you need not be specially concerned whether at present you can see any practical results from such discovery or not. Find the new truth, and neither you nor perhaps any one can foresee what may be its importance in the future. So do not be overanxious as to whether your research has an immediate pecuniary reward in sight. Remember that Louis Agassiz, the greatest zoologist that America has had, said that he did not have time to make money. His regular efforts brought him, however, a comfortable living and a name that will last far longer than that of most of our American multimillionaires. So my counsel to you is that this is largely a personal matter and that your main efforts are to be devoted to producing the best of which you are capable, rather than watching and criticizing the efforts or non-efforts of others. If you earnestly and faithfully attempt to live up to the pledge of this society you will have a clear conscience yourself and in the final estimate of results it is believed you will be classed with the wheat and separated from the tares.

Finally, it is my duty to read to you the pledge of the Society of the Sigma Xi, to which you are asked to assent as your names are called. There is perhaps an appropriateness in the fact that one who was a member of the first list of novitiates of the Alpha Chapter is to put this pledge to you, the youngest members of the Omega Chapter. The pledge is, "Do you hereby pledge yourself to uphold the principles of the Society of the Sigma Xi, and assume the responsibilities incumbent upon active membership therein?"

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Doctorates Conferred by American Universities

The tables here published for the seventeenth year on the doctorates of philosophy conferred by American universities show that the number of degrees this year for the first time exceeded 500, being an increase of 31 over 1913, but of only 18 over 1912. Two hundred and forty-one of the 502 degrees were in the natural and exact sciences, which is about the same proportion as for all the years covered by these sta-